User Guide

AndyMark, Inc. Drive System Components for 2012 *FIRST* Robotics Competition

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System Overview

The 2012 AndyMark Drive System is designed for use in the 2012 *FIRST* Robotics Competition (*FRC*). This Drive System includes standard AndyMark products:

- 2012 C-Base Drive Chassis (am-0938)
- CIMple Box gearbox (am-0734)
- 6" HiGrip *FIRST* Wheels (am-0940)
- 3/8" bore wheel bearings (am-0209)
- #35 ANSI Roller Chain (am-0367) and masterlinks (am-0368)
- 26-tooth Sprocket (am-0737) and mounting screws (am-1123)
- 12-tooth Double Sprocket (am-0736) w/ spacers (am-0947, am-1181)

All of these parts are provided in kit form. Assembly instructions can be found in this manual, and online. CAD files and more detailed layout drawings can be found at www.andymark.com.

Also, AndyMark is happy to be able to donate additional parts to *FRC* teams. Please see our website at the links below for more details on these parts.

- Battery Plugs (am-0122)
- 9015 Motor (am-0912) http://www.andymark.com/product-p/am-0912.htm
- PG71 Gearmotor (am-0914) http://www.andymark.com/product-p/am-0914.htm

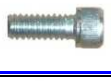
AndyMark, Inc. Background

AndyMark was founded in 2004, when Andy Baker and Mark Koors saw a need to design and sell unique mechanical parts for the competition and educational robotics community. Many designs were being shared and re-created, but finding the correct fabrication resources for these parts was difficult for many competitors, teachers, students, and mentors. As AndyMark grew, so did this demand, and now AndyMark sells parts to all 50 states and to over 30 countries worldwide.

AndyMark is committed to supporting *FIRST*. We are a proud supplier of the *FRC* program since 2005, and the company owners (Andy Baker and Mark Koors) have been *FRC* mentors since 1998. We know the demands of a quick build season and the pressures of 2-minute matches during Regionals and the Championships. For the 2012 *FRC* build season, AndyMark will be working around the clock to meet customers' needs. During the competition season, AndyMark staff will volunteer at many *FRC* Regional events, and we will have a booth at the St. Louis Championships.

We encourage our customers to seek product information on our website, www.andymark.com, or to send us emails at sales@andymark.com. We appreciate phone calls (877-868-4770 toll free) from any customer, but we also are very busy during the January and February *FIRST* build season. During this time, we would prefer emails instead of a phone call to save time and increase our efficiency. We wish all of you the best of luck in the 2012 FRC season, and we hope to see you in St. Louis at the *FIRST* World Championships!

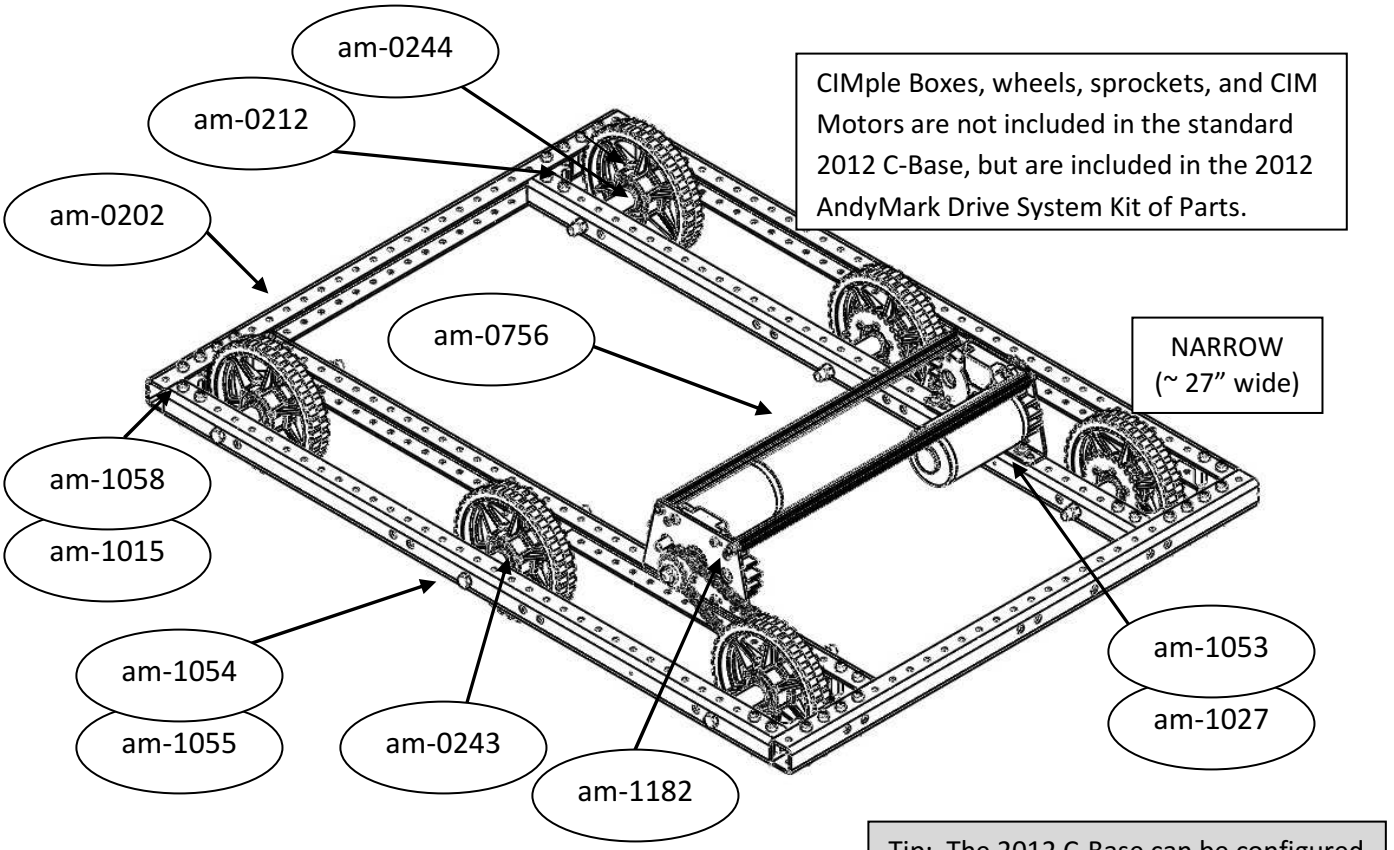
2012 C-Base (am-0938) Bill of Material and Part Photos

Component	Qty	Part Number	Part Photo
C-Channel	6	am-0202	
Corner Connect	8	am-0212	
1860x375 Spacer	6	am-0243	
2550x375 Spacer	6	am-0244	
500 Cross Hex Tube	2	am-0756	
¼-20 Nylock Nut	36	am-1015 sold as pkg: am-1160	
¼ id Washer	4	am-1027 sold as pkg: am-1069	
¼-20 x 5/8 SHCS	4	am-1053 sold as pkg: am-1203	
3/8-16 Nylock Nut	6	am-1054	
3/8-16x7 inch Hex Head Screw	6	am-1055	
1/4-20x1.75 SHCS	32	am-1058 sold as pkg: am-1206	
1/4-20x1 Thread Rolling Screw	4	am-1182	

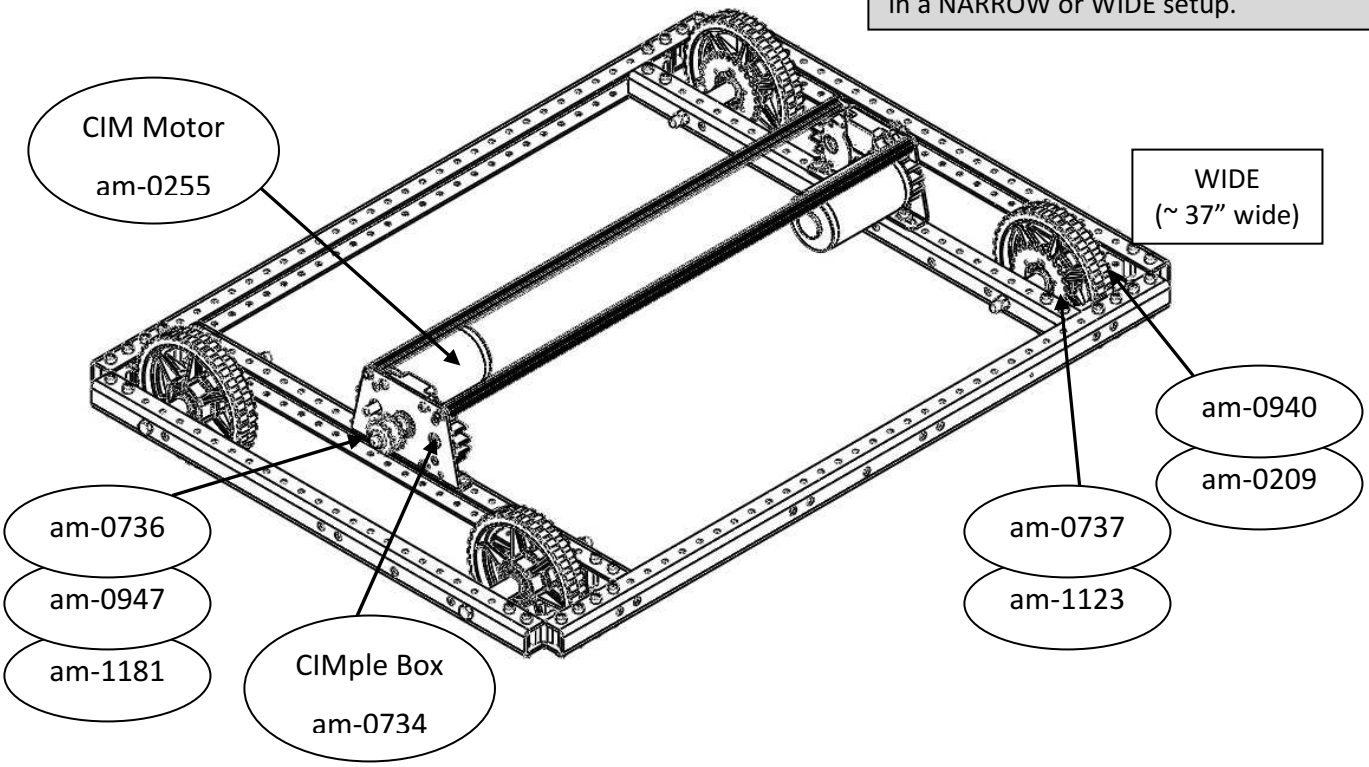
Sprocket and Wheel Bill of Materials

Component	Qty	Part Number	Part Photo	QR Code
3/8” Bore Ball Bearing (1614ZZ)	12	am-0209		
#35 ANSI Roller Chain	10ft.	am-0367		
#35 Masterlink	4	am-0368		
6” HiGrip *FIRST* Wheel	6	am-0940		
S35-12DHE Sprocket	2	am-0736		
S35-26LE Sprocket	4	am-0737		
Shoulder Washer, ½” id	2	am-0947		
Self-tapping #10-24 x 3/4 screw	24	am-1123 sold as pkg: am-1165		
188x500 Spacer	2	am-1181		

2012 AndyMark Drive System Layout Drawing



Tip: The 2012 C-Base can be configured in a NARROW or WIDE setup.



CIMple Box Overview and Specifications

The AndyMark CIMple Box (am-0734) is a single stage spur gearbox. Each *FRC* team receives two (2) CIMple Boxes in their Kit of Parts, unassembled. Assembly instructions are in this manual, and at www.andymark.com/product-p/am-0734.htm. Each CIMple Box includes all parts to mount two 2.5" CIM Motors (two CIM Motors total are included in the Kit of Parts). The US Digital encoders provided in *FIRST* Choice fits onto the CIMple Box, between the two motor mount locations. Here are specifications:

- Gear Profile: AGMA 6
- Gear specifics: 20 dp, 14.5 deg. pressure angle
- Gear material: cold-formed 4140 steel
- CIM Gear: 12 tooth (0.314" inside diameter with 2mm keyway)
- Large Output Gear: 56 tooth (1/2" hex bore)
- Gear Ratio: 4.67:1 (56/12)
- Output Shaft: ½" diameter 4140 steel shaft, 1/8" keyway
- ¼-20 x ½" deep threaded hole at end
- 1 machine key, washer and ¼-20 screw are provided to capture shaft items
- Housing material: Nylon 6/6 with Long Fiberglass Fill
- Shaft plate material: 5052 aluminum

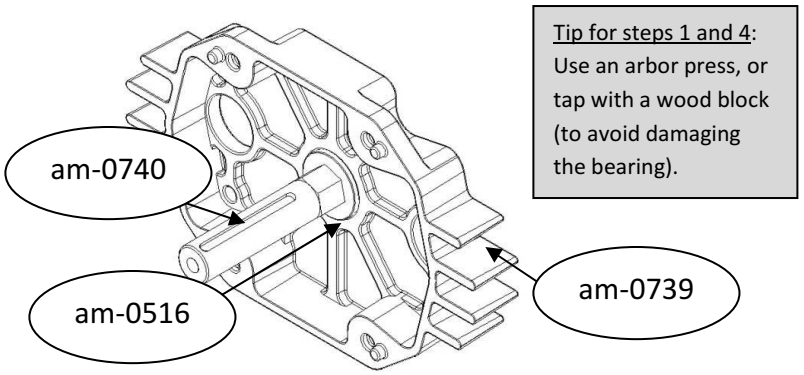
CIMple Box (am-0734) Bill of Material and Part Photos

Component	Qty	Part Number	Part Photo
1/2" id flanged, shielded ball bearing (FR8ZZ)	1	am-0030	
Retainer clip, 8mm id	2	am-0033	
Grease Packet	4	am-0908	
3/8" id bearing, shielded (R6ZZ)	1	am-0516	
CIMple Box Shaft Plate	1	am-0738	
CIMple Box Housing	1	am-0739	
CIMple Box Output Shaft	1	am-0740	
12x520 CIM Gear	2	am-0741	

56 Tooth Output Gear	1	am-0742	
¼ id Washer	1	am-1027 sold as pkg: am-1069	
1/4-20 x 1/2 BHCS	1	am-1039 sold as pkg: am-1202	
10-32 Nylock Nut	4	am-1042 sold as pkg: am-1211	
1/8 x 1/8 x 0.7 machine key	1	am-1043	
10-32 x 5/8 SHCS w/ nylon thread lock patch	8	am-1120 sold as pkg: am-1246	
2x2x10mm machine key	2	am-1121	

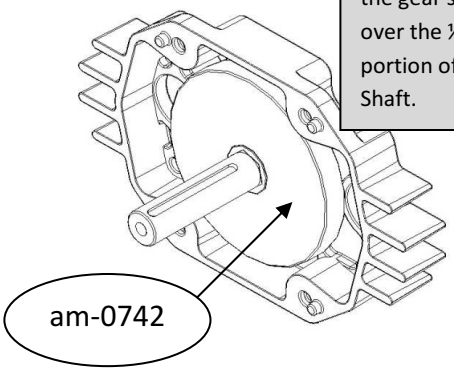
CIMple Box Assembly Instructions

Step 1: Press R6ZZ bearing into Housing. Then, insert Output Shaft into bearing.



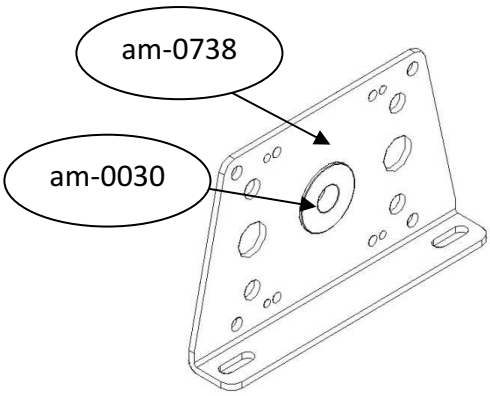
Tip for steps 1 and 4: Use an arbor press, or tap with a wood block (to avoid damaging the bearing).

Step 2: Insert 56 Tooth Output Gear onto Output Shaft.



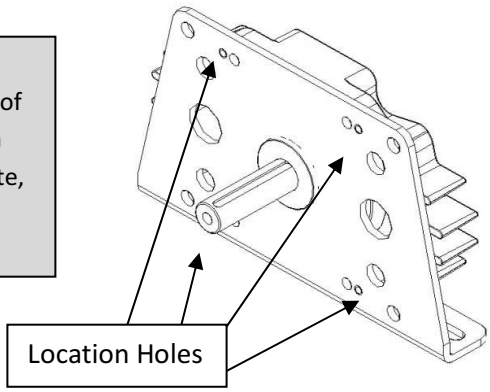
Tip: The ½" hex hole in the gear should slip over the ½" hex portion of the Output Shaft.

Step 3: Insert FR8ZZ Bearing into Shaft Plate.

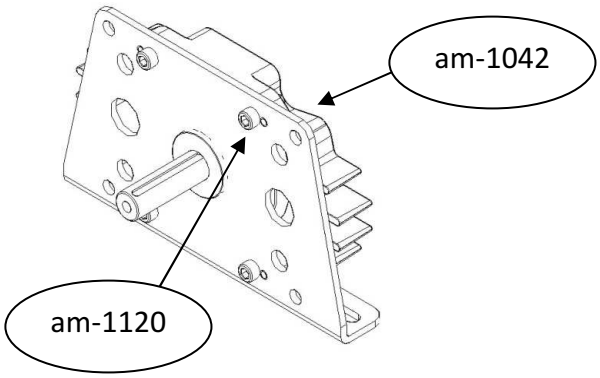


Tip: Be sure that the FR8ZZ flange is inside of the housing. If it is on the outside of the plate, this bearing will eventually fall out.

Step 4: Slide the Shaft Plate and FR8ZZ Bearing onto the Output Shaft. The four locating nubs on the Housing line up with the holes on the Shaft Plate.

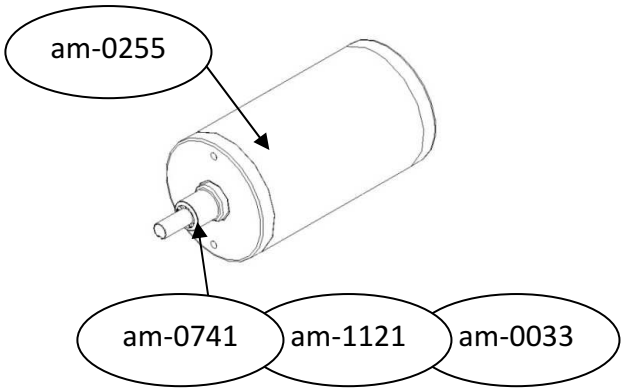


Step 6: One at a time, install 4 Nylock Nuts in the hex pockets on the back side of the Housing. Screw a 10-32 x 5/8" screw into each nut.



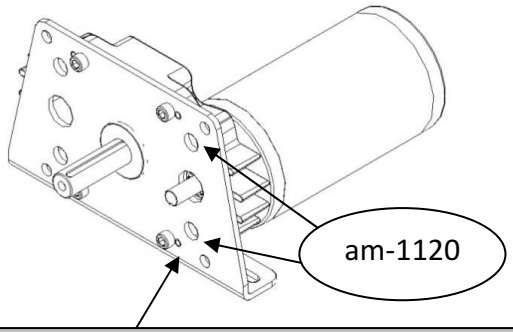
Tip: You won't need a wrench to hold the nut. Just hold it into the pocket with your finger as you are driving the screw with a 5/32" allen driver.

Step 7: Insert the 2x2x10mm Machine Key onto the CIM Motor keyway. Then, slide on the 12x520 CIM Gear so that it almost touches the motor. Lastly, press on the 5/16" Retaining Ring onto the motor shaft to keep the CIM Gear in place.



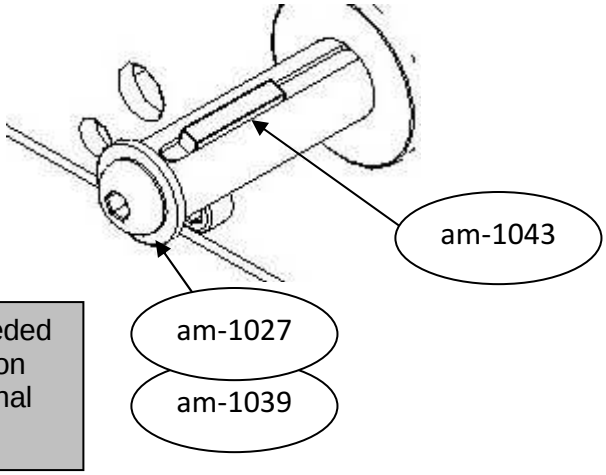
Tips: The retaining clip has small tongs on its interior. Line up one of these tongs to fit into the keyway, and the machine key won't back out. Use a 3/8" socket driver to push the retaining ring into position.

Step 8: Slide the CIM Motor into one of the two motor locations on the Housing. Use two 10-32x5/8" Screws to secure the motor.



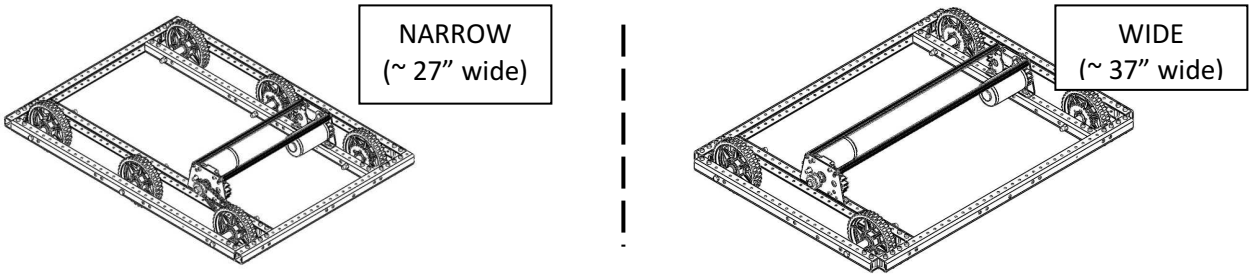
Tip: No additional thread-locking material is needed for these screws (am-1120). The yellow patch on the screw is a thread locking adhesive. Additional thread locking material may harm the Housing.

Step 9: Insert the 1/8x1/8x0.7" Machine Key into the keyway on the Output Shaft. Use the ¼" Washer and Button Head Screw to eventually capture the sprocket on this shaft.

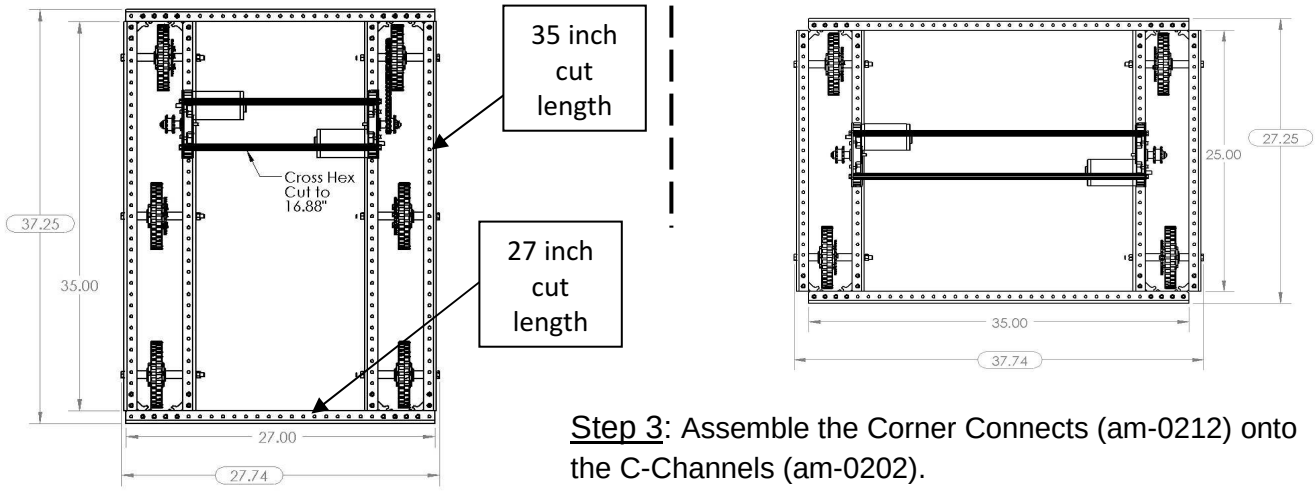


Drive System Assembly Instructions

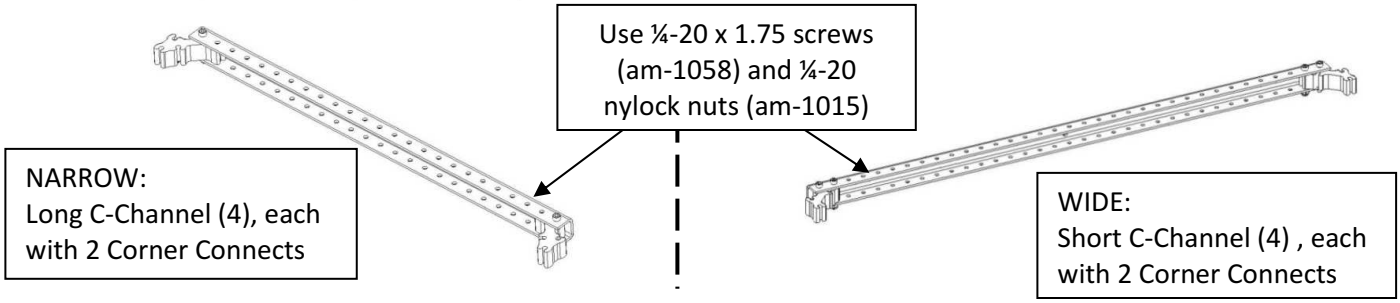
Step 1: Decide whether to use the C-Base in a NARROW or WIDE setup.



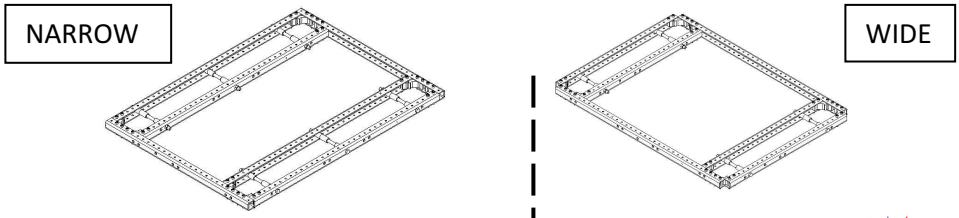
Step 2: Build the C-Base frame by measuring and cutting the correct number of C-Channel pieces to your desired length, as shown in the layout pictures. If you are not sure if you wish to go NARROW or WIDE, then build the C-Base as a 37”x37” square chassis. Realize that this will be too wide for the 2012 *FRC* game, but it gives you time to decide to go NARROW or WIDE.



Step 3: Assemble the Corner Connects (am-0212) onto the C-Channels (am-0202).

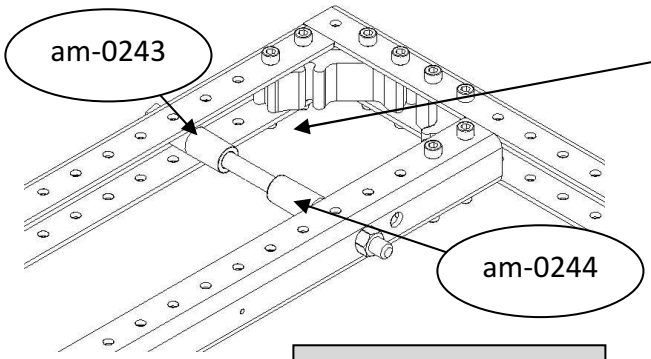


Step 4: Assemble the frame. Insert the 7” screws (am-1055) and spacers. The screws serve as wheel axles. One long spacer (am-0244) and one short spacer (am-0243) are installed on each axle, locating the wheels. Fasten the 3/8” nut (am-1054) on each 7” screw, lightly. This nut will be removed later.

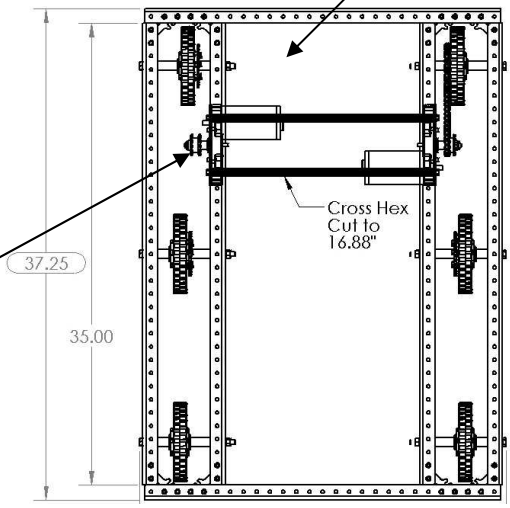


Tip: Make sure the middle axle hole is positioned LOWER than the outside axle holes when assembling. This will position your middle wheel lower and allow your robot to turn.

Tip: If you choose to set up for a WIDE base, be careful to cut the C-Channels and install them so the axle holes line up.



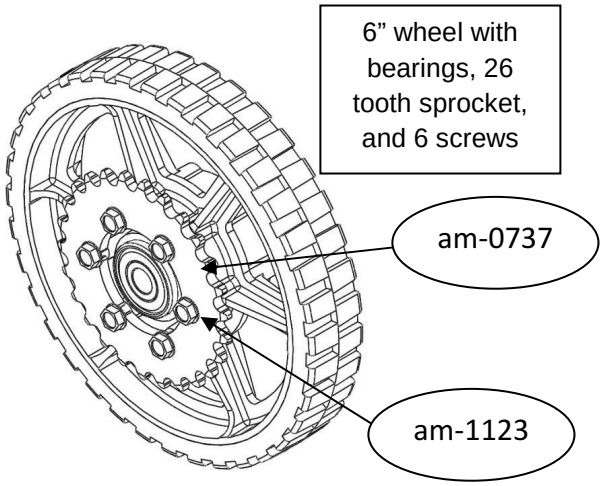
Tip: If you configure your drive system so chain powers all of the wheels, these spacers can be installed in reversed positions on other wheels, aligning chain with the double sprocket on the CIMple Box output shaft.

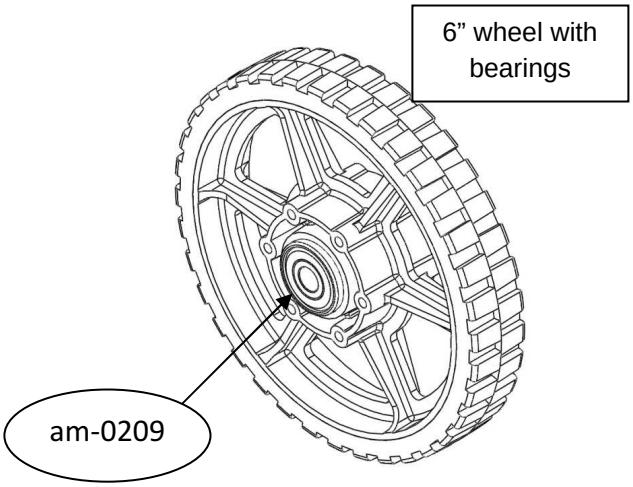


Tip: Notice that the double sprocket lines up with the wheel sprockets, once the wheels are put into place with the proper spacer locations.

Step 5: Prepare the Wheels

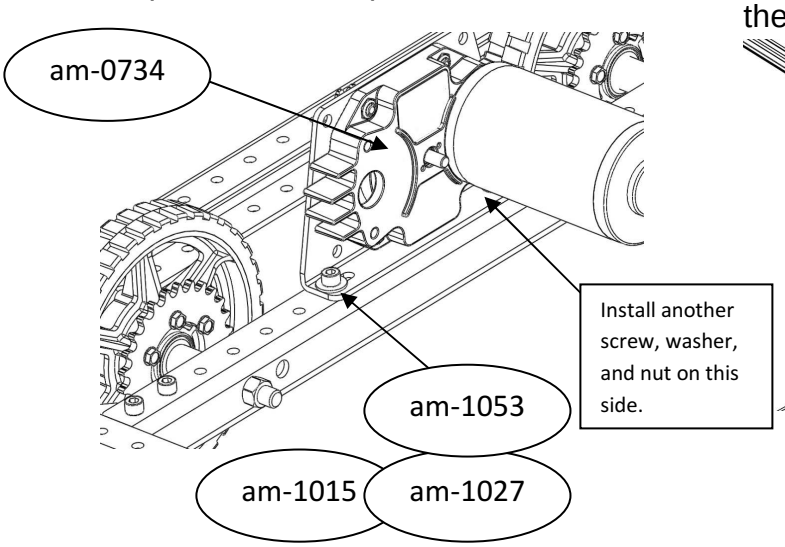
Press two bearings (am-0209) into each HiGrip wheel (am-0940), one bearing on each side. Using kit parts, four wheels per drive system use 26 tooth sprockets (am-0737). For a 6-wheel drive base (as on the NARROW base), four wheels with sprockets and two wheels without sprockets can be used. With a 4-wheel drive base (as on the WIDE base), all four wheels can be fitted with sprockets. 6 screws (am-1123) are used to attach the sprocket to each wheel. These are self-threading screws, so no pre-tapping is needed. Use a 5/16" socket or wrench to drive in these screws.



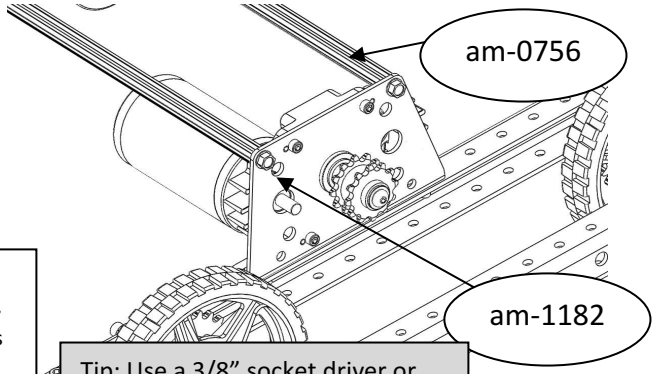


Step 6: Install the wheels where you wish them to be on your C-Base (see the pictures in Step 1 and 2 for locations)

Step 7: Attach CIMple Boxes to C-Base.

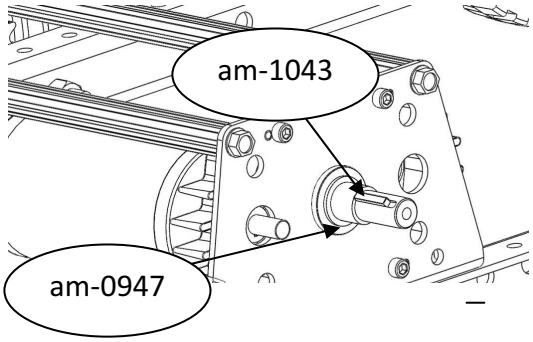


Step 8: Install the Cross Hex tubes, using the ¼-20 x 1" Thread Forming Screws.

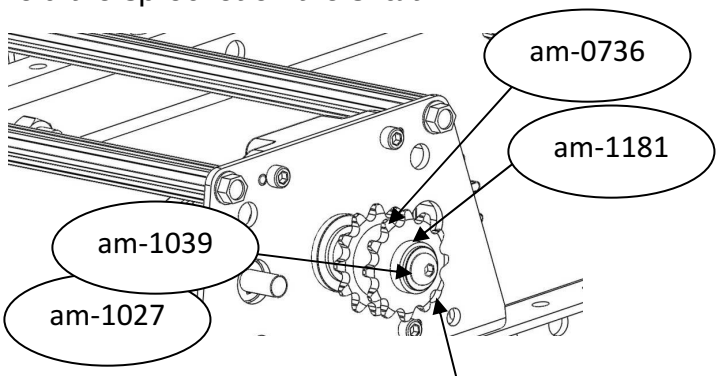


Tip: Use a 3/8" socket driver or wrench to drive the self-tapping screw into the Cross Hex Tube.

Step 9: Install ½" id Shoulder Washer (am-0947) and Machine Key (am-1043).



Step 10: Install the S35-12DHE Sprocket (am-0736) and 188x500 Spacer (am-1181). Use the ¼" washer (am-1027) and ¼-20 BHCS (am-1039) to hold the sprocket on the shaft.

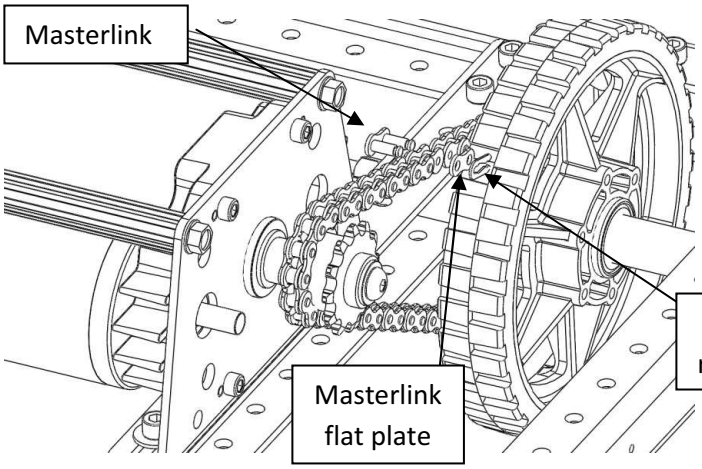


Tip: When installing the ¼-20 screw to cap the shaft, use a thread-locking adhesive on the screw so it does not back out.

Chain Installation Tips

This kit includes #35 series roller chain (am-0367). This industrial chain is different from bike chain, as bike chain has a longer pitch. Bike sprockets do not fit #35 roller chain.

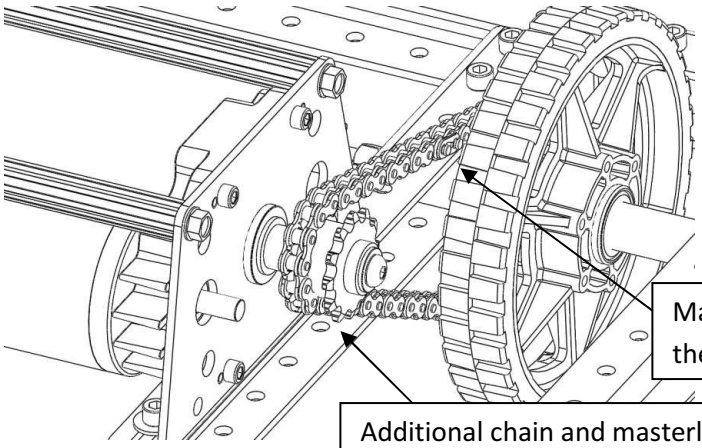
Step 1: Cut the chain to the length needed. Measure out how many links are needed for your chain length (don't forget the masterlink, am-0368, in this estimation). Cut the chain by using a chain breaker, a Dremel tool or grinder. Be SAFE when cutting chain.



Step 2: Wrap the chain around the two sprockets on your robot. Put the ends of the chain in a location where you can easily insert the masterlink.

Tip: The chain shown in the picture is 19-7/8" long (not including the masterlink). Your chain may be this length, or a different length, depending on your design.

Step 3: Slide the masterlink into position, place flat plate and retaining clip into position as shown. Be sure the masterlink posts stick out past the retaining clip so the clip is used properly.



Tip: If this is difficult to do on your robot, install the masterlink without the chain being on the robot. Then adjust the CIMple Box position to put the chain back into place.

Masterlink posts protrude past retaining clip, and the clip rests in the grooves on the posts.

Additional chain and masterlinks are included in the kit so two wheels can be driven by each CIMple Box.

Battery Plug Usage

Four plastic battery plugs (am-0122) are included in the 2012 AndyMark Drive System kit. These plugs are intended to be flags for charged batteries. They are not to be used on uncharged batteries.

Procedure for using these battery plugs:

1. Remove charged battery from charger.
2. Insert battery plug into the charged battery's red connector.
3. Place battery on shelf. Anyone can see now that battery is charged.
4. Remove battery plug before installing battery on robot.
5. Remove uncharged, spent battery from robot, but do not put battery plug back in to uncharged battery, or someone else will think it is charged.

Charged battery with plug

Battery being charged

Uncharged battery without battery plug